DOCUMENT RESUME

ED 204 148 SE 035 253

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TITLE The Differences Among Science and Humanities Males and Females.
PUB DATE Apr 81
NOTE 8p.: Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (54th, Grossinger's in the Catskills, Ellenville, NY, April 5-8, 1981). Not available in hard copy due to marginal legibility of original document.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Biological Sciences: *Career Choice: College Science: *Females: Higher Education: Humanities: Physical Sciences: *Predictor Variables: *Science Careers: Science Education: Scientists: *Sex Differences: Spatial Ability: *Student Attitudes: Undergraduate Students
IDENTIFIERS *Science Education Research

ABSTRACT

This paper provides results of a study which characterized women in science, aimed at identifying those factors thought to discriminate among males and females in the humanities, biological sciences, and physical sciences. The areas of spatial ability, attitude toward science, and rate of maturation were chosen as possible discriminating variables. Males and female undergraduate humanities and science majors (N=86) were given two Educational Testing Service spatial tests, and additional information was collected concerning major, science hobbies, number of previous science courses, and a short essay on feelings about pursuing a career in science. Included among the results of this study was that, regardless of sex, spatial ability and a positive attitude toward science are factors which influence a choice of career in science. (CS)

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NARST 1981

The Differences Among Science and Humanities Males and Females

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The number of women in science has become a major concern of science educators in the last few years. Various programs have been established to increase their numbers, providing skills, information and role models. It is this concern that led me to undertake the following study.

The focus of this study is the characteristics of women in science; the purpose is to identify factors which would discriminate among males and females in the humanities, biological and physical sciences. The areas of spatial ability, attitude toward science and rate of maturation were chosen as possible discriminating variables. These were chosen because previous research on sex differences indicate that males are better at spatial tasks than females (Maccoby & Jacklin, 1974) and further that spatial ability is a factor of success in science (Talley, 1973; Siemankowski, 1971). Boys also have a more favorable attitude toward science than girls (Koelsche, 1971; Lowery, 1966; Meyer, 1961). Rate of maturation according to Waber (1977) is a discriminating characteristic of individuals linked to spatial ability, that is, early maturing males and females have poorer spatial ability than late maturing males and females.

Eighty-six male and female undergraduate humanities and science majors were given two Educational Testing Service spatial tests; VZ3 to test visualization and S2 to test spatial orientation (Ekstrom et al., 1976). Additional information concerning major, number of science hobbies, previous science courses taken in high school and college and a short essay on their feelings about pursuing a career in science were collected. The essay was scored 0 to 2 as follows:

(0): the student indicated that they disliked science or were actively pursuing a career in a non-science field,

(1): the student was indifferent to science or liked science but was thinking of other possible careers,

(2): the student liked science and was planning a career in science or a related field.

Rate of maturation was determined by retrospective report given in months. Females reported age of onset of menarche and males reported the age at which they experienced an adolescent growth spurt, i.e. the time during adolescence when they grew several inches in a short period of time (Tanner, 1962).

The following six groups were created for combination in discriminant analysis: female non-science majors (n=13); female biology majors (n=16); female physical science majors (n=18); male non-science majors (n=16); male physical science majors (n=12); male biology majors (n=16). Biology, botony, zoology and pre-med were placed in the biology group. Mathematics, engineering, computer science, chemistry, geology and physics were placed in the physical science group. All others were placed in the non-science group.

In the first discriminant analysis the data was grouped according to sex regardless of major: n=47 females and 44 males. There were no variables which were able to discriminate between the males and females.

The second discriminant analysis grouped the sample by biology (n=32), physical science (n=30) and non-science (n=24) regardless of sex. In this analysis, attitude, number of science courses previously taken and spatial ability on S2 were the discriminating variables. The first of two functions accounted for 98.19% of the variance in the sample. On this function the canonical coefficient for attitude was .86, for S2 .30 and for courses .30. Attitude is clearly the most important vatiable. Group centroids for each group

on the first function were -2.0 for non-science, .72 for biology and .84 for physical science, indicating that non-science majors are quite different form biological and physical acience majors but that the science majors do not differ from each other.

A third discriminant analysis was performed to test for a sex by major interaction using the six groups mentioned above. In this case three functions were generated with function one accounting for 90.76% of the variance. Attitude and spatial ability on S2 were the variables which distinguished among groups. Number of courses was removed from the equation because it diminished the discriminating power among the six groups. The canonical coefficients in function one were .92 for attitude and .32 for S2. The group centroids on this function for these groups are as follows:

female non-science	= -2.0
female biology	= .67
female physical science	= .76
male non-science	= -1.8
male biology	= .75
male physical science	= .77

Again it can be seen that the variables discriminate between science and non-science majors but not between males and females in each of the majors or between biology and physical science majors.

Correlations indicate that there is no relationship between rate of maturation and any other variable. Waber's hypothesis that women have poorer spatial ability than men because they mature earlier than men was disconfirmed. Spatial ability on S2 correlated with major .30, courses .40 and attitude .40, $p < .001$. Within science. for males, attitude correlated with spatial ability .44, $p < .05$ and major .52, $p < .01$. For females, the only correlation with

attitude was the number of science courses previously taken .42, $p < .01$.

The expected sex differences in attitude and spatial ability do not appear in this study. Instead, differences in attitude and spatial ability reflect major rather than sex. These discrepancies can be resolved by considering the nature of samples. Science majors in universities are a self-selected population. In order to major in science the student must have had a large number of science courses in high school and met with a fairly high level of success. Students whose level of spatial ability did not provide them with success in science would naturally develop a negative attitude toward science. Conversely, a negative attitude could also contribute to lack of success. A negative attitude and lack of success would lead such students to drop science from their studies at that point in high school where they have fulfilled the minimum science requirements.

Testing of students before they can voluntarily withdraw from science would provide a sample in which attitude and spatial ability would show a wide range of variability and sex differences in spatial ability and attitude toward science. Testing groups in which the voluntary withdrawal from science has taken place would eliminate sex differences. Differences between science and humanities gropus could reasonably be expected to occur regardless of the sex of the members of each group because of the essentially different nature of the two majors.

It appears that factors influencing a choice of a career in science are spatial ability and attitude toward science for both males and females.

For women, the attitudinal factor is more important than the cognitive factor, although how these two may be related is unclear. Nevertheless, once women are in science it is not possible to distinguish them from men on the basis of attitude or spatial ability. They are however, very different from men who are not in science on these two variables.

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